Name:	Class:	Class Register Number:

CHUNG CHENG HIGH SCHOOL (MAIN)

Chung Cheng High School Chung Cheng High School Chung Cheng High School Chung Cheng High School Chung Cheng High School

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Parent's Signature

PRELIMINARY EXAMINATION 2021
SECONDARY 4

MATHEMATICS   4048/01

Paper 1   **Wednesday 15 September 2021**

2 hours

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Answer **all** questions.
If working is needed for any question it must be shown with the answer.
Omission of essential working will result in loss of marks.
The use of an approved scientific calculator is expected, where appropriate.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [   ] at the end of each question or part question.

The total number of marks for this paper is 80.

For Examiner's Use	
Total	**/ 80**

This document consists of **19** printed pages and **1** blank page.

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Mathematical Formulae

Compound interest

$$\text{Total amount} = P\left(1 + \frac{r}{100}\right)^n$$

Mensuration

$$\text{Curved surface area of a cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

$$\text{Volume of a cone} = \frac{1}{3}\pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

$$\text{Area of triangle } ABC = \frac{1}{2}ab\sin C$$

$$\text{Arc length} = r\theta \text{ , where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2}r^2\theta \text{ , where } \theta \text{ is in radians}$$

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$$

Answer **all** the questions.

1   State which of the following number(s) is/are irrational.

$$0.\dot{5}, \quad \frac{\pi}{2}, \quad 2\sqrt{2}, \quad 3\sqrt{3}\times\sqrt{3}$$

Answer .... [1]

2   x is an integer greater than 1.
Write the following in order of size, starting with the largest.

$$x^0, \quad x^{-\frac{3}{2}}, \quad x^{\frac{3}{4}}, \quad x^{\frac{3}{2}}$$

Answer .... [1]

3   The graph shows the number of cyclists in an annual cycling marathon for the years 2017 to 2019.

Number of cyclists
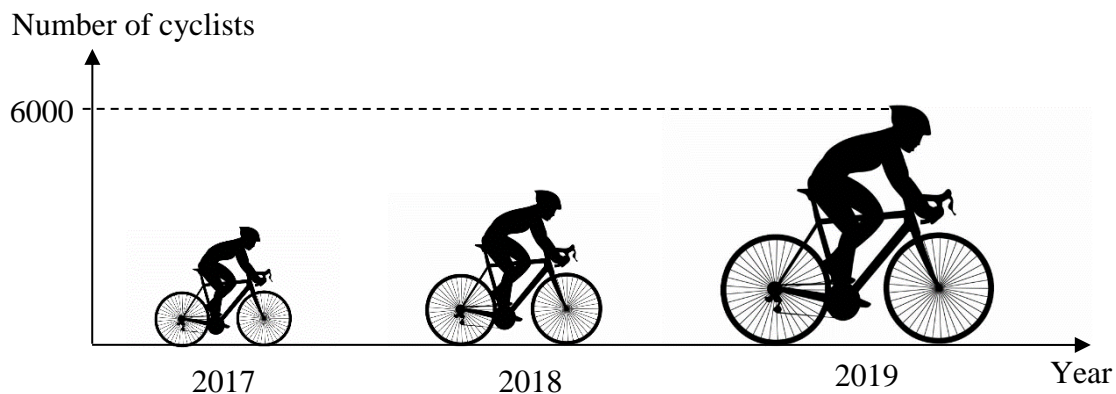
(a) State one aspect of the graph that may be misleading.

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(b) Explain how this may lead to a misinterpretation of the graph.

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4 **(a)** Simplify $\left(\dfrac{2^{a-1}\sqrt{2}}{2^{a}} \right)^{2}$.

Answer .... [2]

(b) If $27m^{3x} = 1$ and $m > 0$, find $m^{2x} + m^{-x}$.

Answer .... [2]

5 n is a positive integer.

Show that, for all n, $\left(5n+3\right)^{2} - \left(5n-3\right)^{2}$ is a multiple of 4.

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6   Gladys wrote down four numbers.
The mean of these numbers is 13, the median is 12 and the mode is 10.
Find the four numbers.

Answer .... [2]

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7   **(a)**   Mrs Boey deposited $20 000 in a bank that pays 0.8% per annum compound interest compounded half-yearly. Find the total amount of money she will receive at the end of 5 years, leaving your answer to the nearest cent.

Answer .... [2]

(b)

> Singapore Budget 2018: GST to be raised from 7% to 9% some time between 2021 and 2025

Shane and Glen came across an article in the newspaper with the headline shown above and made the following comments.

Shane: Oh no, the GST will increase **by** 2% soon!

Glen: No! I disagree. It did not increase by 2%, in fact it is **MORE** than 2%!

Whose statement is correct? Support your answer with mathematical calculations.

Answer .... [2]

[Turn over

8 **(a)** Find the range of values of x which satisfy the inequalities

$$\frac{17-8x}{3} < \frac{2(3x-1)}{5} \le 4.$$

Answer .... [3]

(b) Hence, state the smallest prime number that satisfies the inequalities.

Answer .... [1]

9 **(a)** Factorise completely $9b^2 - 6ab + a^2 - x^2$.

Answer .... [2]

(b) Simplify $\dfrac{5}{2x^2 - 7x - 4} - \dfrac{8}{4-x}$.

Answer .... [3]

10 Roy made a model of his yacht with a scale of 1: 40.

(a) The actual length of the yacht is 12.5 m, find the length of the model in cm.

Answer ....cm [1]

(b) Roy wants to spray paint his yacht. He can select either of the following options to paint his yacht.

Option A: A lump sum payment of $1 000
Option B: Payment for cost of paint at $5.50 per m^2
[Cost of manpower is included in both options]

If the total surface area of the model to be painted is 937.5 cm^2, find the surface area of his yacht. Which one of the two options should Roy select to paint his yacht? [Show your workings clearly]

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11 $\xi = \{x : x \text{ is an integer and } 1 \le x \le 10\}$

     $A = \{x : x \text{ is a factor of } 20\}$

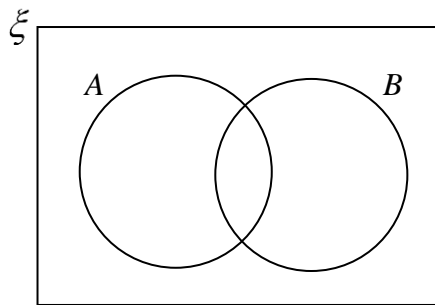 $B = \{x : x \text{ is a perfect square}\}$

     Find

     (a) $n(B)$,

Answer .... [1]

     (b) $A' \cap B'$.

Answer .... [1]

     (c)   On the Venn Diagram, shade the region which represents $(A \cup B)' \cup (A \cap B)$.

[1]

12 When written as the product of their prime factors,

p is $2^2 \times 3 \times 5$,

q is $2^6 \times 3^3$,

r is $2^2 \times 3^2 \times 11$.

Find

(a) the value of the cube root of q,

Answer .... [1]

(b) the LCM of p, q and r, giving your answer as the product of its prime factors,

Answer .... [1]

(c) the greatest number that will divide p, q and r exactly.

Answer .... [1]

13 The diagram shows a regular pentagon and a regular octagon. Calculate the value of x.
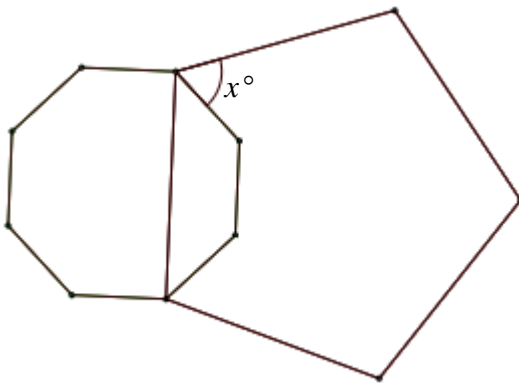
Answer $x =$ .... [3]

14 The diagram shows a rhombus *ABCD*.

ABQ, *PBC* and *DRQ* are straight lines and *AQ = BP*.
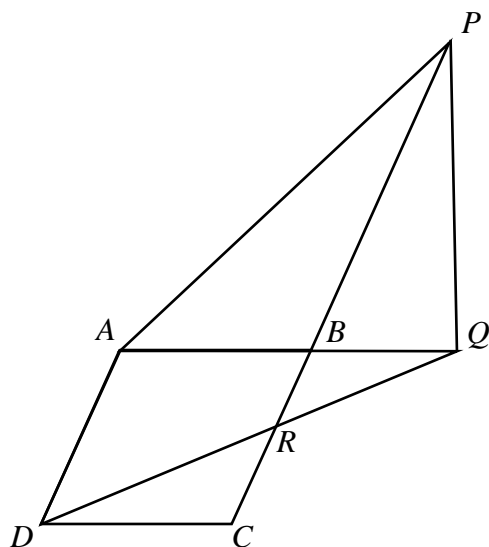
(a) State the triangle that is similar to triangle *BRQ*.

Answer Triangle .... [1]

(b) Prove that triangle *DQA* is congruent to triangle *APB*.

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15

A, B, D and E are points on the circle such that AD = CD and angle BCD = 28°.
Explain with geometrical reasons, why the length of BC equals to BE.

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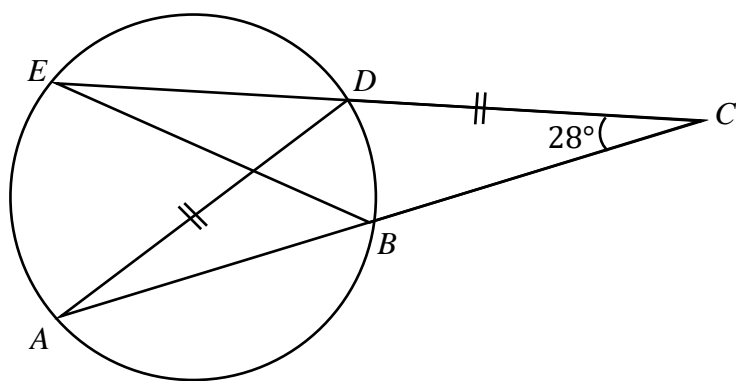
16 The masses of 20 bags, in kg, are measured.
The results are shown on the stem-and-leaf diagram.

Mass of 20 bags

Stem	Leaf
0	9
1	2
2	0 6 6 6
3	0 3 3 4 4 8 8
4	1 2 9 9 9
5	0 1

Key: 0|9 means 0.9 kg

(a) Find the mean mass of the bags.

Answer ....kg [1]

(b) Find the standard deviation of the masses of the bags.

Answer ....kg [1]

(c) It was found later that the weighing machine has an error.
Each bag was actually 0.08 kg heavier.
Explain how this will affect the mean and standard deviation.

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17   *y* is inversely proportional to the square of *x*, *x* > 0.

(a)   If *x* is increased by 25%, find the percentage change in *y*.

Answer ....% [2]

(b)   Given that *y* = 16 when $x = \dfrac{1}{2}$, find

(i)   the equation connecting *y* and *x*,

Answer .... [2]

(ii)   the value of *x* when *y* = 100.

Answer   *x* =.............................. [2]

(c)   Sketch the graph which represents the relation between *y* and *x*.
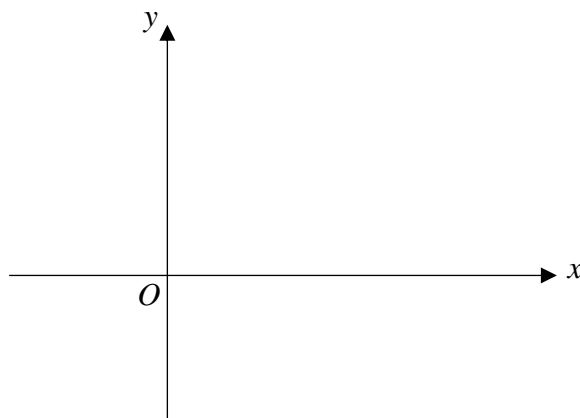
[1]

18 In the following sequence,

$$(1 \times 2) - 2 = 0$$
$$(2 \times 3) - 4 = 2$$
$$(3 \times 4) - 6 = 6$$
$$(4 \times 5) - 8 = 12$$

....

....

$$(a \times 12) - b = c$$

....

....

$$(d \times e) - f = g$$

(a) Find the values of a, b and c.

Answer $a =$…………., $b =$ ……….., $c =$................ [2]

(b) Express g in terms of d.

Answer .... [2]

(c) Explain why 279 cannot be the result of an equation in this sequence.

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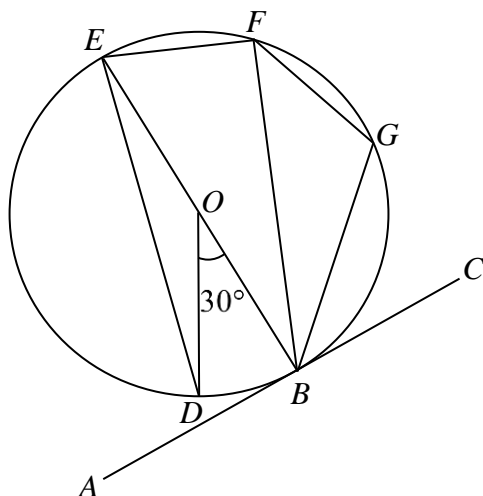
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19 The diagram shows a circle *BDEFG*, centre *O* and diameter *BE.* The line *AC* is a tangent to the circle at *B* and angle $BOD = 30°$. The ratio of angle *EBF* to angle *FBG* to angle *GBC* is 1 : 1 : 2.

(a) State a fact about the arcs *EF* and *FG*.

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(b) Showing all reasons clearly, find
    (i) angle *DEB*,

Answer .... [1]

    (ii) angle *EFG.*

Answer .... [2]

20 **(a)** Express $-x^2 + 4x + 12$ in the form $-(x+p)(x-q)$.

Answer .... [1]

(b) Sketch the graph of $y = -x^2 + 4x + 12$ on the axes below.
Indicate clearly the values where the graph crosses both axes. [2]
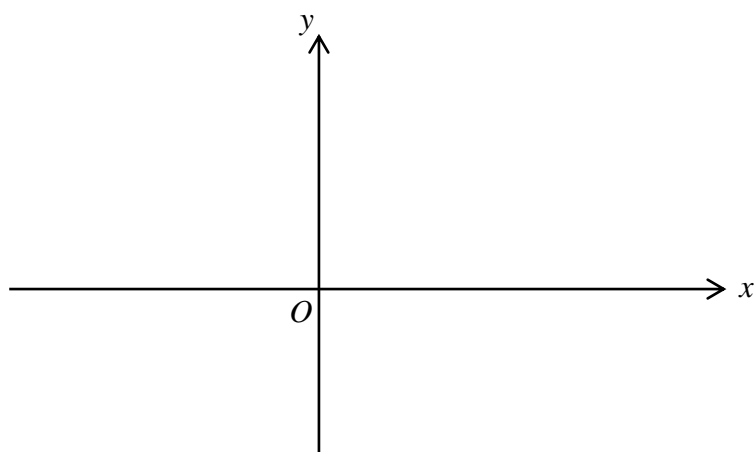
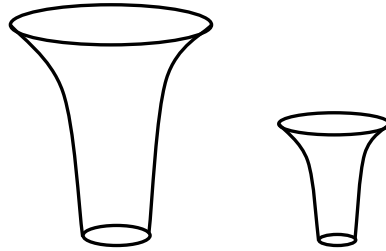**(c)** Find the coordinates of the turning point.

Answer (…….……., …….……..) [1]

(d) Without solving the equation algebraically, explain why $-x^2 + 4x + 12 = 18$ has no solution.

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21 The diagram shows two geometrically similar containers. The cost of painting the base area of the smaller container is $\dfrac{25}{64}$ of the cost of painting the base of the larger container.
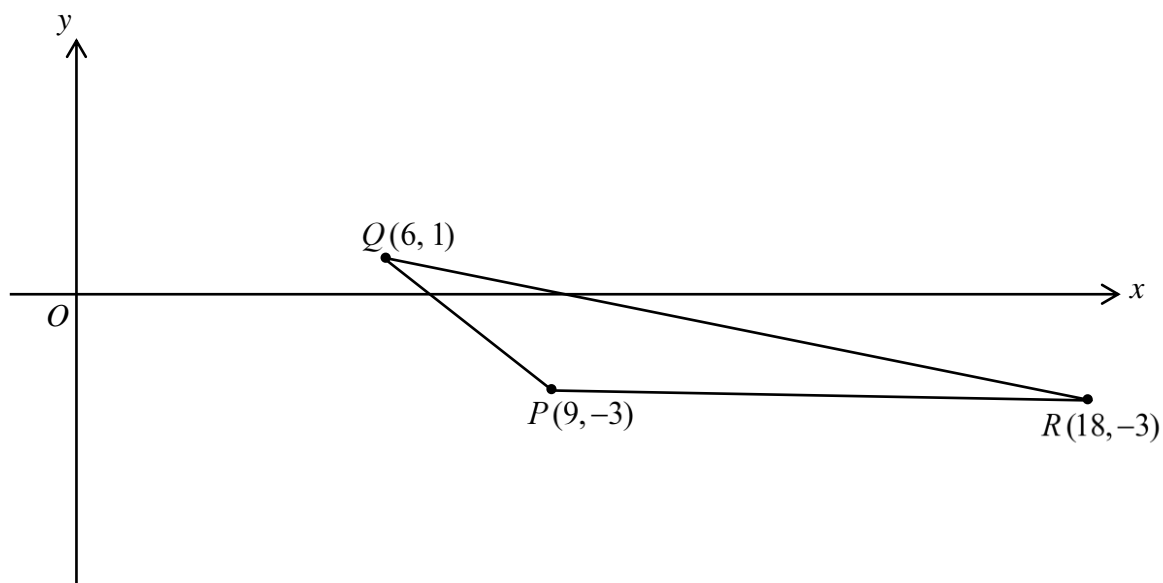

(a) The top of the larger container has a circumference of 24 cm.
Find the circumference of the top of the smaller container.

Answer .... cm [2]

(b) The capacity of the smaller container is 0.45 litres.
Find the capacity of the larger container, giving your answer to 2 decimal places.

Answer .... litres [1]

[Turn over

22

In the diagram, the points P, Q and R have coordinates $(9, -3)$, $(6, 1)$ and $(18, -3)$ respectively.

(a) Find the length of PQ.

Answer ....units [1]

(b) Find the value of $\cos \angle QPR$, giving your answer as a fraction in its simplest form.

Answer .... [1]

(c) Find the area of triangle PQR.

Answer ....units^2 [1]

(d) Find the equation of the line *PQ*.

Answer .... [2]

(e) The equation of a line passing through the point *R* is $4x + 21y = 9$.

Find the coordinates of the point of intersection of this line and the line *PQ*.

Answer .... [3]

~ End of Paper ~

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